

The Future of CORS

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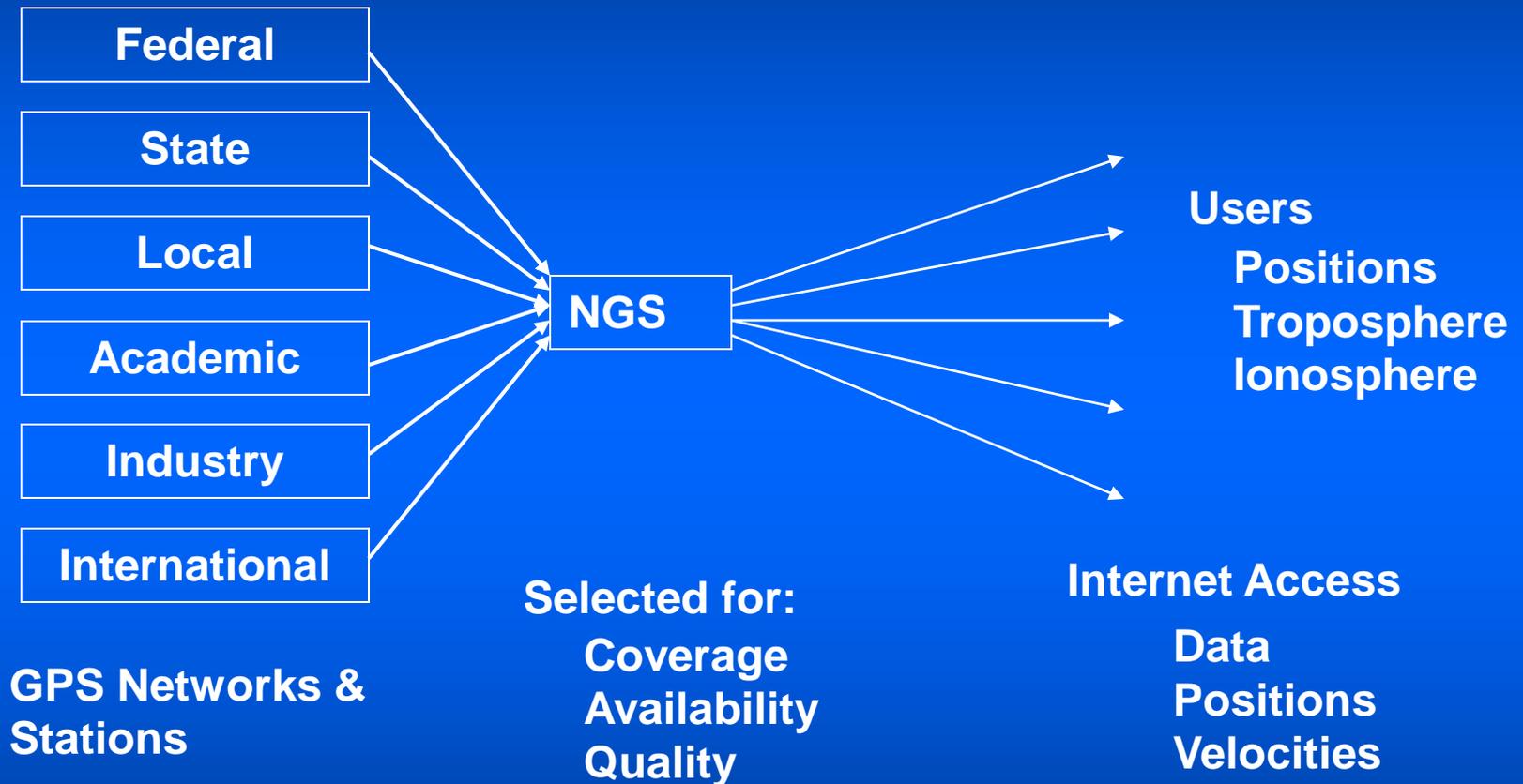


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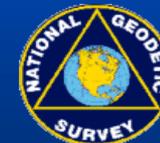


Positioning America for the Future

What is CORS?

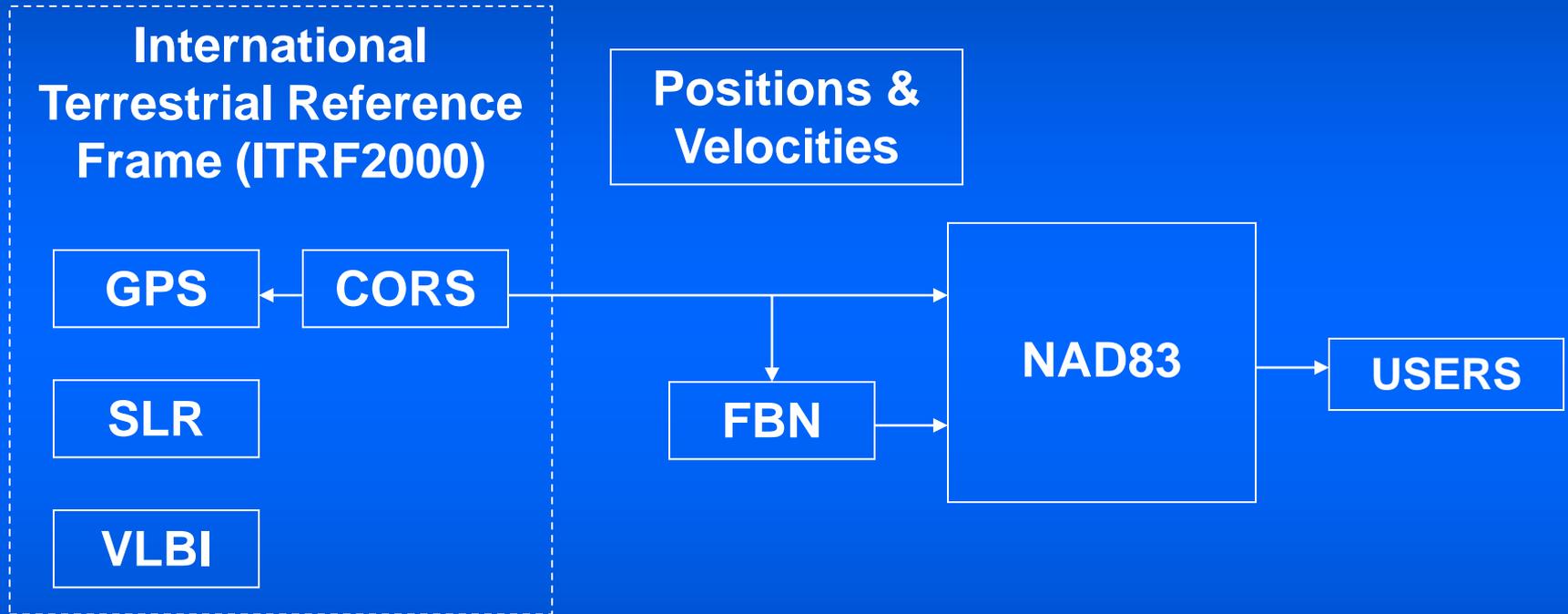


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CORS Defines NSRS



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How Large a Network?

- Efficiency
 - user time on-site
 - fix integers
 - propagation effects
- Redundancy
- Crustal Motions



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In the Next Few Years ...

- Number of available stations is increasing
- Selection effect
- Emphasize CORS quality over coverage
- Rationale needed
 - number of stations
 - spacing
 - data rate



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CORS OBJECTIVE

- Enable Positioning:
 - at the best possible accuracy
 - with minimal time on site
 - by providing the data & products to support the most advanced geodetic positioning techniques
- Enable Better Weather Forecasts
 - troposphere
 - ionosphere



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Choices

- How many stations
- What station spacing
- What data rates
- What data latency
- Stable monumentation
- Multipath factors
- Ease of data access



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Station Spacing

- Orbit accuracy not a factor
 - IGS Ultra Rapid orbits - real-time
 - IGS precise orbits for post-processing
- Propagation errors set station spacing
 - ionosphere & troposphere decorrelate with distance
 - ambiguities diverge from integer values
 - fast/accurate positions need “fixed integers”



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Station Spacing

- CORS Network will be used to model/interpolate propagation effects
- To keep number of stations manageable, find maximum distance that still permits accurate propagation modeling



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Evaluation Tests

- US Coast Guard broadcasting carrier phases and pseudoranges from Hagerstown NDGPS station (HA-NDGPS)
- NGS supplementing with local network to model propagation
- Enable cm-level positioning (even in real-time)



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HA-NDGPS Preliminary Test



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HA-NDGPS Initial Test Results

- Interpolate tropo/ion from reference baselines to sol1-hag1 baseline
- Approaching single epoch ambiguity resolution



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Data Rates

- High-rate (1 s) data
- “Real” Data
 - bandwidth
 - archiving
- “Synthetic” data
 - interpolated (post-processing)
 - extrapolated (real-time)



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RMS of “Synthetic-Real” Differences

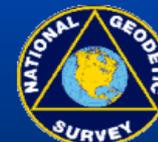
**Interpolated from sampled 1 sec
kinematic ship-borne data - June 2001**

Synthesized From:	North(mm)	East(mm)	Up(mm)
5 sec	1.5	1.0	2.6
15 sec	2.5	1.7	5.7
30 sec	5.1	3.2	13.3

15 sec would be adequate for 1 cm work



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Data Latency

- Nobody wants to wait
- Streaming data
 - from current epoch forwards
 - long connect times
 - navigation
- Buffered data
 - from current epoch backwards
 - short connect time
 - rapid static & post-processed kinematic



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CORS Trends - 1

- Number of stations will level off at 400-500
- Station spacing ~150 km
- Stations selected for quality (vs. coverage)
- Data rate of 5 sec
- Buffered data
- Propagation products (ion & tropo)
- In Situ antenna calibrations

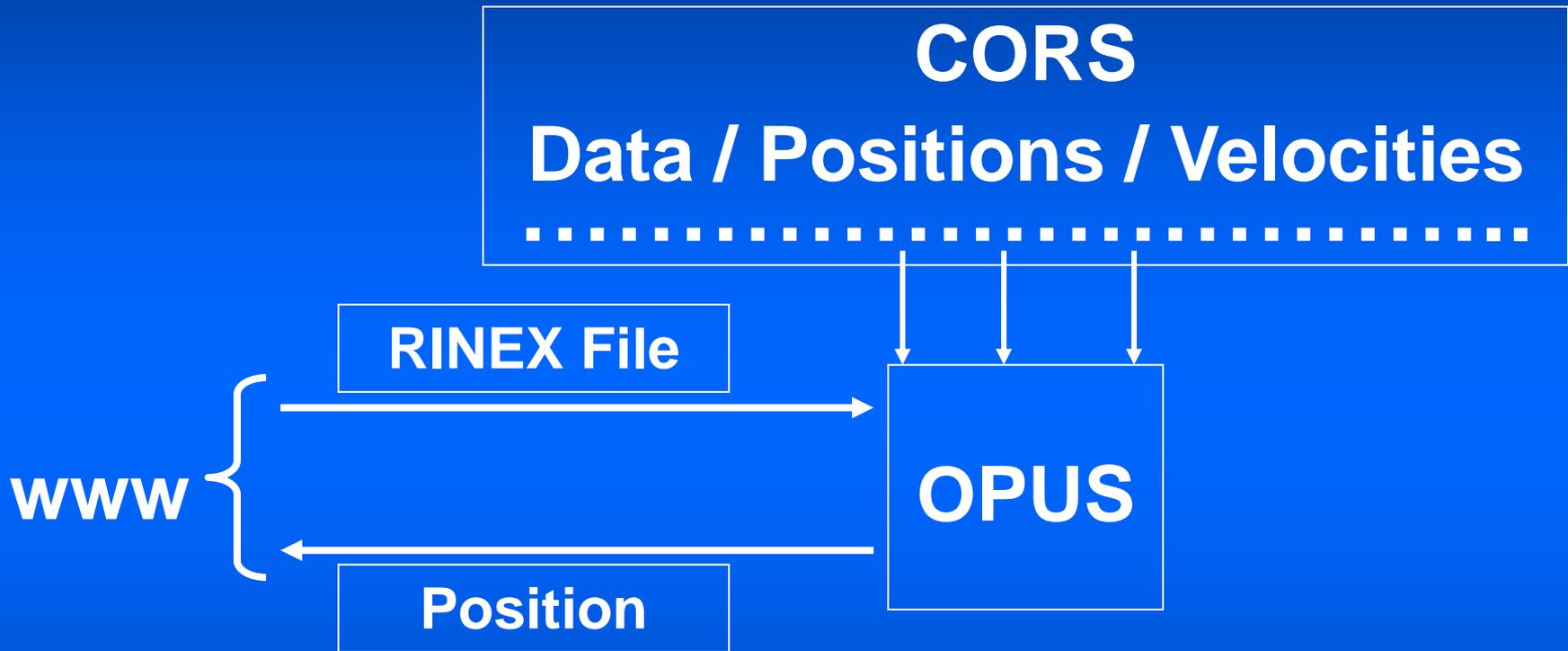


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On-line Positioning User Service



- Fast / Easy access to NSRS
- Minimum data span - 2 hr

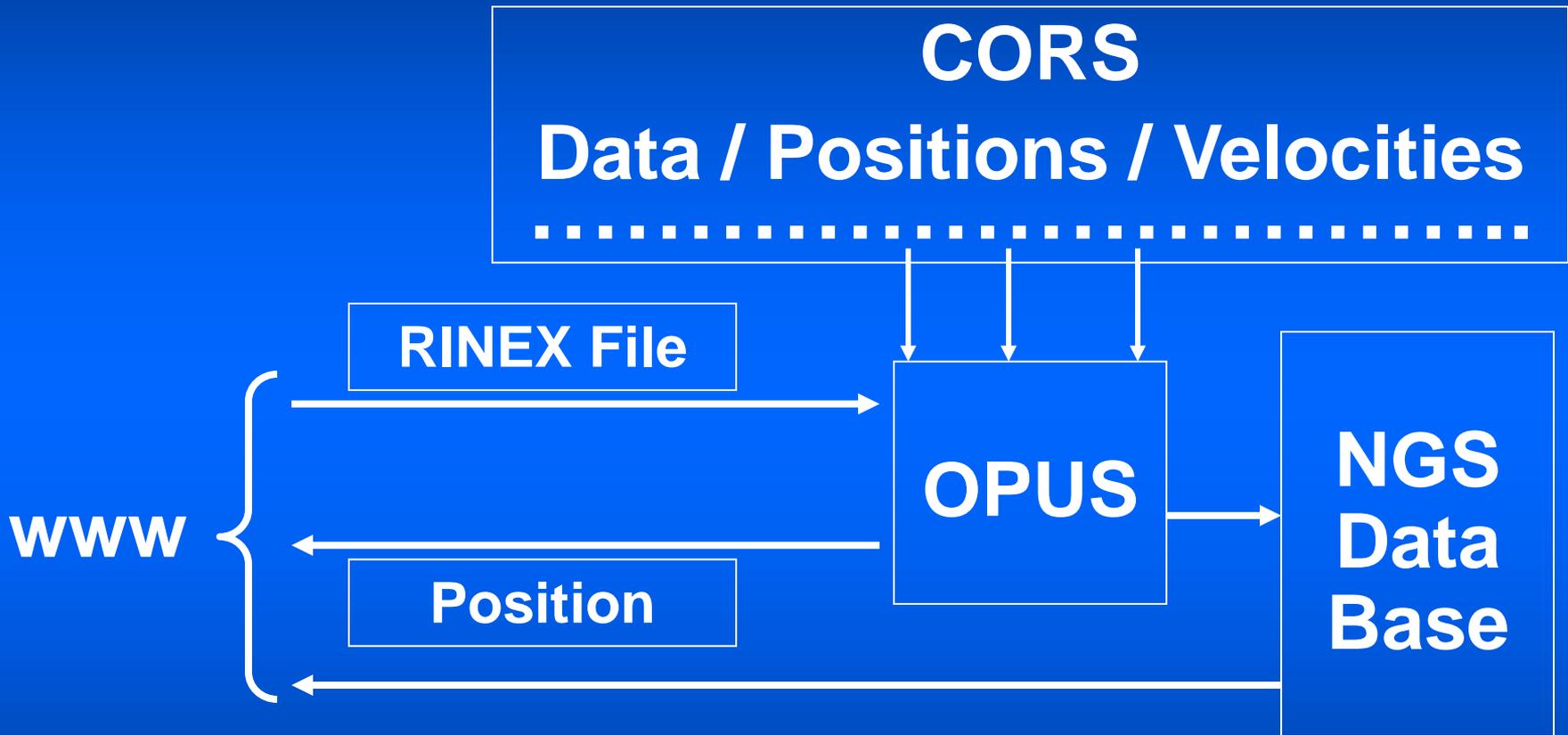


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OPUS - Future Plans



→ **Minimum data span -15 min**



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CORS Trends - 2

- Users will replace monumented control stations at national level with CORS/OPUS
- Monumented control at state/local level?
- Basis for tropo. water vapor monitoring
- High spatial/temporal ionosphere modeling
- Inclusion of L2C & L5
- Inclusion of Galileo & Glonass ?



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Discussion Questions

- CORRS
 - additional requirements?
 - mechanisms for future cooperation?
 - your role in CORRS?
- OPUS
 - additional features desired?
 - project submission utility?



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